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citizens of Germany, whose residence and post office addresses are
Brahmsstrasse 1b, 59302 Oelde; and Mönkingstrasse 19, 59320 Ennigerloh,
Germany, have invented certain new and useful improvements in a

FLAT FABRIC

of which the following is a complete specification:

FLAT FABRIC

CROSS-REFERENCES TO RELATED APPLICATIONS

[0001] This application claims the priority of German Patent Application Serial No. 200 21 305.9, filed December 16, 2000, the subject matter of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] The present invention relates to a flat fabric, e.g., a wire fabric, and more particularly to a fabric of a type having warp threads and weft threads running transversely to the warp threads.

[0003] Fabrics are generally known and used in a wide variety of applications. They include two thread systems which normally intersect one another at a right angle. One group of threads runs in longitudinal direction of the fabric and is called warp threads. Thus, the warp threads are of a same length as the fabric. The other transverse thread group runs in the direction that is determinative for the width of the fabric. These threads are called weft threads. The warp and weft threads can intersect in many ways by passing the weft threads over and under the warp threads to realize a desired weave pattern. Widely used weave patterns include the so-called linen weave or the twill weave.

From these types of patterns, various derived weaves can be formed.

[0004] The linen weave involves a continuously repeating pattern of a weft thread passing over and under the warp thread, whereby the next weft thread, as viewed in the direction of the warp threads, is positioned on the other side of the warp threads. The twill weave is characterized by warp threads which pass over at least two weft threads, whereby the next following weft thread is positioned above the warp thread. The parts of the warp threads that are positioned above the weft threads are further positioned in offset relationship.

[0005] In particular, when wire fabrics are used, a wide variety of greatly different components can be fabricated. Recently, wire fabrics found even application in the electronic field. It becomes then necessary to configure the fabric in compliance with the requirements at hand.

[0006] It would be desirable and advantageous to provide an improved flat fabric which has threads that, depending on the application, can be captured either individually or bundled in a different sequence again and again, for subsequent bonding or insulation or attachment to other components, and which can easily be further processed by means of known handling devices.

SUMMARY OF THE INVENTION

[0007] According to one aspect of the present invention, a flat fabric includes a body portion having opposite fringe portions and first threads running in one direction and second threads running transversely to the first threads, wherein one of the first and second threads is made of an electrically conductive material and the other one of the first and second threads is made of an electrically conductive material surrounded by an insulating envelope, or made entirely of an electrically insulating material, wherein the opposite fringe portions are realized exclusively by the threads of electrically conductive material.

[0008] Since the threads running in one direction are now mutually insulated from one another, electric energy can flow through the other threads. This opens up many possibilities to use the fabric according to the present invention. As both opposite fringe portions include only warp threads or only weft threads, the fabric can be suited to the use at hand. The wires may be utilized individually; It is, however, also possible to bond two or more wires or threads together, whereby the number of wires or threads being bonded together can be suited to the intended pattern being selected. Optionally, they can be insulated or attached to other components.

[0009] For sake of simplicity, the following description will refer primarily to "thread" only, but it will be understood by persons skilled in the art, that the

principles described in the following description with respect to "threads" are generally applicable to "wires". To ensure clarity, it is necessary to establish the definition of some terms and expressions that will be used throughout this disclosure. The terms "single" or "singling" in conjunction with threads are used here to indicate that parts of threads have been unraveled to be present in single formation.

[0010] Singling of the threads and also bonding together of single threads in accordance with a predetermined pattern can be facilitated, when the body portion of the fabric has strips, which adjoin the fringe portions that are made exclusively of threads of one direction, and which are formed by a weaving pattern that differs from the weaving pattern of the central portion located between the strips, so that at least a predetermined number of electrically conductive threads can be bonded together in the outer fringe portions. The central portion of the fabric may then be formed with a weave pattern which is best suited to the application at hand of the fabric, whereas the adjacent strips can be formed with a weave pattern which is best suited to implement a fringing or singling of the threads or to implement a bonding of the threads together. It is not necessarily required to form the central portion only in one weave pattern, because also this portion can be formed of several weave patterns that deviate from one another.

[0011] According to another feature of the present invention, the body

portion has an overall size, with the fringe portions covering about 40% of the overall size, the strips covering about 20% of the overall size, and the central portion covering about 40% of the overall size. It is to be understood by persons skilled in the art that the term "overall size" is used here in a generic sense and refers to the width or length of the fabric depending as to whether the fringe portions are free of weft threads or warp threads. Of course, these numeric data are given by way of example only, as the true lengths of the fringe portions and the adjacent strips may stay the same, when enlarging or reducing the fabric in size, i.e. in length or width, so that the central portion is dependent on the size of the fabric.

[0012] According to another feature of the present invention, the first threads are weft threads of electrically conductive material, and the second threads are warp threads made of electrically conductive material surrounded by an envelope of electrically insulating material, or made entirely of electrically insulating material. This configuration is currently a preferred embodiment, as it is advantageous for fabrication of a flat fabric according to the invention.

[0013] According to another feature of the present invention, the strips are formed by a twill weave, whereas the central portion is formed by a linen weave or by several types of weave patterns. By forming the strips in accordance with a twill weave, singling or bonding together of the threads is facilitated. The number of electrically conductive wires to be bonded together can be varied because of

the twill weave of the strips adjacent the outer fringe portions. For example, a so-called 5+1 weave allows bonding together of five threads whereas the next following thread can be utilized as single thread. It is also conceivable to vary the number of threads being bonded together in the direction of the insulated threads, when using a different weave pattern.

[0014] According to another feature of the present invention, the segments of the warp threads passing over and under the weft threads can be positioned in offset relationship, preferably by one waft thread, to the strips formed in twill weave. The twill weave of the strips should then be so designed that two threads of electrically conductive material can be bonded together in each outer fringe portion, while the offset relationship by one waft thread results on the other side in an endless weft thread which can then be used in an insulating fabric as resistance wire.

BRIEF DESCRIPTION OF THE DRAWING

[0015] Other features and advantages of the present invention will be more readily apparent upon reading the following description of currently preferred exemplified embodiments of the invention with reference to the accompanying drawing, in which:

[0016] FIG. 1 is a first embodiment of a flat fabric according to the present invention;

[0017] FIG. 1a is a cross sectional view, on an enlarged scale, of a warp thread used in the present invention;

[0018] FIG. 2 is a second embodiment of a flat fabric according to the present invention; and

[0019] FIG. 3 is a third embodiment of a flat fabric according to the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0020] Throughout all the Figures, same or corresponding elements are generally indicated by same reference numerals.

[0021] Turning now to the drawing, and in particular to FIG. 1, there is shown a first embodiment of a flat fabric according to the present invention having a body portion, generally designated by reference numeral 10. The body portion 10 is made of a plurality of warp threads 11 in parallel, spaced-apart relationship and weft threads 12 running transversely at a right angle to the warp threads 11 in parallel, spaced-apart relationship. The warp threads 11 and the

weft threads 12 are made of metal so as to be electrically conductive. As shown in FIG. 1a, the warp threads 11 are made of a core metal fiber 16 which is surrounded by an envelope 17 of electrically insulating, and thus non-conductive material. A suitable material would be, for example, plastic. Of course, it is also conceivable to make the warp threads entirely of electrically insulating material.

[0022] The weft threads 12 terminate on opposite ends in fringe portions 12a which extend beyond both outer warp threads 11 and include single weft threads 12. The free fringe portions 12a of all weft threads 12 are bonded together in accordance with a predetermined pattern, whereby some weft threads 12 remain separate and run individually, as indicated by reference numeral 12b. Depending on the application at hand, the free fringe portions 12a of the weft threads 12 of the flat fabric may also be electrically connected to other components, or may also be insulated or provided with connectors.

[0023] The body portion 10 of the fabric has a central portion 13 which is formed by a linen weave. Thus, the warp threads 11 and the weft threads 12 intersect in a continuously repeating pattern by passing one of the threads 11 or 12 over and under the other one of the threads 12 or 11. Adjacent one side of the central portion 13 is a strip 14, and adjacent the other side of the central portion 13 is a strip 15, whereby both strips 14, 15 are made by a twill weave. In the non-limiting example of FIG. 1, the twill weave is configured as 5/1 weave, i.e., the warp threads 11 pass over five weft threads 12, whereas the next

following weft thread 12 is positioned above. These weft threads 12 are guided individually past the weft threads 11 to form the fringe portions 12a, with the five weft threads 12 bonded together, and the next following weft thread 12 remaining single. In the non-limiting example of FIG. 1, the strips 14, 15 are formed by seven warp threads 11.

[0024] By way of example, the fringe portions 12a may cover about 40% of the overall size of the body portion 10, while the strips 14, 15 cover about 20% of the overall size, and the central portion 13 covers about 40% of the overall size.

[0025] FIG. 1 shows that singling and bonding together of the fringe portions 12a of the weft threads 12 is facilitated by the twill weave of the strips 14, 15. Through the outer warp threads 11, the strips 14, 15 are formed by such a weave that singling or bonding together of the fringe portions 12a of the weft threads 12 is given by the weave pattern.

[0026] Referring now to FIG. 2, there is shown a second embodiment of a flat fabric according to the present invention. Parts corresponding with those in FIG. 1 are denoted by identical reference numerals and not explained again. In this embodiment, provision is made for a configuration of the strips 14, 15 in twill weave of nine warp threads by a so-called 3/2 weave, i.e., the warp threads 11 pass over three weft threads 12 while the next two weft threads 12 are placed over the warp threads 11. The central portion 13 is identical to the embodiment of

FIG. 1 and is formed through a linen weave. The fringe portions 12a of the weft threads 12 are bonded together by alternately bonding together three and two weft threads 12.

[0027] FIG. 3 shows another embodiment of a fabric according to the present invention, in which the strips 14, 15 are formed by a twill weave in a so-called 2/2 weave, i.e. the warp threads 11 are alternately passed over and under two weft threads 12. As a consequence, two weft threads 12 are respectively bonded together at the fringe portions 12a. FIG. 3 further shows that the warp threads 11 between both strips 14, 15 are shifted by a weft thread 12 so as to attain an endless configuration of the weft threads 12. In this way, the weft threads 12 may be utilized in an insulating fabric as resistance wire. As stated above, the warp threads 11 and the weft threads 12 are made of metallic wires, in the event the fabric is constructed for use as wire fabric.

[0028] A flat fabric according to the present invention is useful for the production of electronic items.

[0029] The warp threads 11 and the weft threads 12 are made of wires of relatively small diameter so that the fabric may also be referred to a fine fabric.

[0030] While the invention has been illustrated and described as embodied in a flat fabric, it is not intended to be limited to the details shown since various

modifications and structural changes may be made without departing in any way from the spirit of the present invention. The embodiments were chosen and described in order to best explain the principles of the invention and practical application to thereby enable a person skilled in the art to best utilize the invention and various embodiments with various modifications as are suited to the particular use contemplated. Of course, other configurations which generally follow the concepts outlined here are considered to be covered by this disclosure.

[0031] What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims and their equivalents: